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Magnetic and Mössbauer studies of L10–FePt/Fe/Ta multilayer structures

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Abstract

© 2017, Pleiades Publishing, Ltd.Magnetic L10–FePt(10 nm)/Fe(t, nm)/Ta(2 nm) (t is the Fe film thickness that is varied from 0 to 15 nm) multilayer structures have been prepared by magnetron codeposition. The 2-nm-thick Ta layer is a corrosion protection. The magnetization reversal processes and the magnetic interactions have been studied. The hysteresis loops measured in the plane of a single-layer L10–FePt films demonstrate a near-linear behavior. N the magnetic multilayer FePt(10 nm)/Fe(t, nm)/Ta(2 nm) system, in which the Fe layer thickness is smaller than 3 nm, the FePt/Fe system behaves as a single-phase magnetic material and the coercivity is close to the values determined by the Zeeman energy. In the case when the Fe layer thickness in the magnetic multilayer FePt(10 nm)/Fe(t, nm)/Ta(2 nm) structure is larger than 3 nm, the hysteresis loops measured in the structure plane indicate that the FePt/Fe film possesses the properties analogous to the properties of a soft magnetic material. The Mössbauer studies showed that the minimal deviation of the magnetic moments on the normal to the multilayer structure surface was observed as the Fe layer thickness is 1 nm. The increase in the Fe layer thickness to values higher than 1 nm led to the increase in the angle of deflection θ to ~40° at t = 15 nm. In this case, the coercivity of the multilayer structure slowly decreased, because of the limitations of the exchange bond length between the FePt and Fe layers. The measured values of the coercivity were optimized using relationship 1/tFe1.15.

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